EFFECT OF SUPPLEMENTATION OF CINNAMON, GINGER AND MORINGA POWDER BASED DIETS ON ANTI-OXIDANT ACTIVITIES OF BREAST MEAT OF BROILERS

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ABSTRACT
This study was aimed at assessing the effects of cinnamon powder (CP), ginger powder (GP) and moringa leaf meal (MLM) dietary supplementation on antioxidant activities of breast meat of broilers. A basal diet divided into four portions, designated as diet 1 (control) and diets 2, 3and 4 supplemented with 0.2% cinnamon, 0.2% ginger root and 0.2% moringa leaf meal, respectively. Ninety-six 1 day old broiler chicks were randomly assigned to the four experimental diets (24 birds/diet), 6 birds per replicate using a Completely Randomized Design. At the end of the day 56 , 100g of the broiler meat were excised from the breast meat for determination of antioxidant activities on breast meat of broiler as affected by phytogenic supplements. The glutathione peroxidase concentration were significantly (P<0.05) higher in breast meat from birds fed diets containing the phytogenic supplements compared to control diet. The lipid peroxidase activities in the meat from birds fed diets 2 and 4 were (P>0.05) similar but higher (P<0.05) than those birds on diet 3. In conclusion, phytogenic supplementations increased the glutathione peroxidase concentration and reduced lipid peroxidation of breast meat of broilers.
Keywords: Phytogenic supplements, breast meat, anti-oxidative activities, ginger

INTRODUCTION

The use of direct feed antibiotics is restricted in many nations which has increased interest in alternatives like phytogens, a class of all natural compounds that has been the subject of multiple research in recent years. These plant –derived products have been shown to have a properties as well as improvements in gut health and growth efficiency (Yang *et al*., 2015). Phytogenic supplemented diets have been proven to enhance body weight (BW) and feed conversion ratio (FCR) in broilers according to a recent field trial study (Sudhir *et al*., 2016). These herbal additions in broiler feed increase the shelf life of meat. Meat and meat products are good source of protein with a high biological value, fat soluble, vitamins, minerals and bioactive substances include meat and meat products. Meat and meat products are intricate systems with rich nutritional make up, they are particularly vulnerable to bacterial and chemical deterioration. The primary contributor to chemical degradation in meat is lipid oxidation which most likely begins in the animal's muscles while it is still alive and worsens after slaughter as a result of environmental changes a decrease in intrinsic antioxidant capability. It is well established that the use of exogenous antioxidants in feeds can improve the meat's lipid stability (Li and Lui, 2012). In general, dietary strategies to reduce the effects of lipid oxidation on meat involve changes in the lipid composition of the feeds and antioxidant supplementation. The aim of this study was to determine the antioxidant activity on meat of broilers as affected by phytogenic supplements.

Materials and methods

Location of the experimental site: The study was carried out in the poultry unit of Teaching and Research farm, department of Agricultural Technology. The Federal Polytechnic, Ado, Ekiti-State, Nigeria. The state is situated in Southwest of Nigeria. Ekiti State covers a land area of 6355km square (2,453sqm) with a population of estimated in 2010 to be 3,737,199. It enjoys a tropical climate with two different seasons, these are dry and rainy season. (April to October) rainy season (November to March) dry season. Ado-Ekiti has a temperature range between 21^0C to 28^0C.

Site preparation

The poultry house was thoroughly washed, fumigated and disinfected. The house was allowed to stay for two weeks before the arrival of experimental birds and proper weeding of the surrounding was carried out to prevent reptiles.

Test ingredients

The ginger and cinnamon were purchased from a local market while the moringa leaf was plucked from the premises of Federal Polytechnic, Ado. The moringa leaf was air-dried for seven days while the cinnamon and ginger were air-dried for 13 days and then ground into a fine powder (particle size: 0.25-0.30mm) and were packed into an airtight containers.

Management of experimental birds: A total number of ninety-six (96) birds of Cobb-500 breeds were used for the experiment. The birds were purchased from a reputable hatchery for this study. The chicks were brooded for two weeks for acclimatization using electric bulb as a source of light and heat in the pen. In the brooding house enough provision was made for space, ventilation, polythene were also used to cover the pen to provide warmth and protection against predators and extreme of weather. They were fed the experimental diet for 8 weeks. Proper and adequate management practice was observed. All vaccination were given as appropriate through the period of the experiment. Feed and water were given *ad-libitum.*

Experimental diets

The composition of experimental diets were presented in tables 1. The basal diets were formulated for broiler starter (0-28 day) and finisher (29-56 day). The experimental diets used for the study were compounded on the floor at the premises of the Teaching and Research Farm, Federal Polytechnic, Ado-Ekiti. The diets were formulated to be iso-caloric and iso-nitrogenous. Diet 1- control diet (diet without any supplementation), diet 2 - 0.2% cinnamon powder supplementation (CP), diet 3- 0.2% ginger powder supplementation (GP), diet 4 - 0.2% of moringa leaf meal (MLM).

Table 1: Composition of experimental diets (%) for broiler starter

Ingredients	1	2	3	4
Cinnamon	-	0.2	-	-
Ginger	-	-	0.2	-
Moringa leaf meal	-	-	-	0.2
Maize	53	53	53	53
Soyabean cake	22	22	22	22
Groundnut cake	16	16	16	16
Fish meal	2	2	2	2
Bone meal	3	3	3	3
Limestone	2	2	2	2
Broiler premix	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Common salt	0.25	0.25	0.25	0.25
Vegetable oil	1	1	1	1
Total	100	100	100	100
Calculated composition				
Metabolizable energy(Kcal/kg)	2980	2980	2980	2980
Crude Protein (%)	21.8	21.8	21.8	21.8
Average calcium	1.99	1.99	1.99	1.99
Average phosphorus	0.69	0.69	0.69	0.69
Lysine	1.33	1.33	1.33	1.33

Experimental design

A total number of ninety-six (96) birds were used in this study. They were four experimental diets with four replicates per treatment, six birds were allocated per replicate amounting to 24 birds per treatment using a Completely Randomized Design. The birds were used to access the antioxidant activities on meat of broiler chickens as affected by phytogenic supplements.

Data collection
100g of meat was excised from the breast part of the chicken for antioxidant activity of superoxide dismutase, lipid peroxidation as outlined by (Bostoglou *et al*.,1994), catalase activity (Hadwan and khabt, 2018) and glutathione peroxidase activity as described by (Cichoski *et al*., 2012).
Statistical Analysis: The data obtained in this study were subjected to one-way analysis of variance using the SPSS software. The means were compared using Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

The effects of phytogenic supplement on catalase (GAT), glutathione peroxidase (GPx), superoxide dismutase (SOD) and lipid peroxidation of the meat were shown in table 2. The catalase activity was not affected (P>0.05) by dietary treatment. The GPx activities were significantly (P<0.05) increased in diets 2, 3 and 4. The highest GPx was recorded in breast meat from the birds fed diet 3. The values recorded for SOD activity were not affected (P>0.05) by the phytogenic supplements though the values recorded for breast meat from birds fed diets 2, 3 and 4 were higher than the value recorded for breast meat of birds fed control diet. The lipid peroxidation values of breast meat from birds fed 0.2% CP and 0.2% MLM were similar (P>0.05) but significantly (P<0.05) higher than the values recorded for breast meat from birds fed 0.2% GP. The highest value of lipid peroxidation was recorded in breast meat from birds fed control diet at 15.62 while the least value was recorded in breast meat from birds fed 0.2% GP at 5.67mgMDA/100g.

Table 2. Effect of phytogenic supplements on antioxidants activities of broiler meat

Parameters	*Phytogenic supplements* (%)				SEM	*p- value*
	T1	T2	T3	T4		
	0	0.2CP	0.2GP	0.2MLM		
Catalase (U/mL)	112.84	114.38	115.07	113.97	12.86	0.87
GPx (mg/mL)	138.34^{b}	166.84^{a}	167.89^{a}	165.92^{a}	12.42	0.02
SOD (%)	0.95	1.31	1.10	1.16	0.13	0.84
Lipid peroxidation	15.62^{a}	8.02^{b}	5.67^{c}	7.57^{b}	1.26	0.01

a, b, c Means within a row with different letters are significantly different (P<0.05) : SEM standard error of mean.; GPx- glutathione peroxidase; SOD: superoxide dismutase

The oxidative process that occurs while meat is within its shelf life might reduce its nutritional and sensory qualities (Kumar *et al.*, 2015). Therefore, methods that encourage the prevention of lipid and protein oxidation will prolong the usable life and shelf life of meat (Velasco and Williams 2011). This is due to the fact that the development of lipid oxidation encourages the loss of physiological function, modification of membrane properties, deactivation of enzymes, denaturation and rupture leading to cellular component leakage (Bekhit *et al.*, 2013). Natural antioxidants in animal production are being discussed in recent times (Brewer, 2011) to improve the health of the animals and the meat's shelf life by boosting the oxidative status antimere and preventing the deposition of antioxidants in the meat during the animals' lives (Descalzo and Sancho, 2008).
The elimination of hydrogen peroxide (H_2O_2) depends on the availability of catalase and glutathione peroxidase (Marchi *et al.*, 2012). The higher glutathione peroxidase concentration found in the meat from the birds fed the study's supplemented diets of cinnamon, garlic, and moringa leaf meal revealed the possibility that these phytogenic supplements could change the antioxidant enzymes in the muscular system, increasing the meat's shelf life (Bekhit *et al.*, 2013). The fact that dietary inclusion of phytogenic in animals' diets during production could reduce the lipid peroxidation activities and subsequently improve the meat shelf life which is further supported by the reduced lipid peroxidation activities in the meat of the birds fed phytogenic supplements in this study (Valenzuela-Grijaiva *et al.*, 2017). The low value of lipid peroxidation recorded in meat from broiler fed 0.2% ginger powder might be due to the presence of bioactive compounds present in the ginger powder.

CONCLUSION

In this study, the phytogenic supplements on the breast meat of the broilers reduced the lipid peroxidation activities and increased the shelf life of the breast meat of broilers

RECOMMENDATION

Ginger powder is recommended in this study because it reduced the levels of lipid peroxidation of the meat and increased the glutathione peroxidase concentration.

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